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OBSERVATIONS ON THE PTERIDOPHYTIC FLORA OF SIMLA HILLS (NORTH WESTERN HIMALAYAS)

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ABSTRACT

Ecological and distributional data about the Peteridophytic Flora of Simla Hills in the North Western Himalayas is presented in this paper. Detailed observations on the habitat of various species have been made. In all, 121 species (9 Fern-Allies and 112 Ferns) were collected, out of which, 22 are new records for the area. Amongst the interesting and rare ones are, *Cheilanthes chrysophylla* Hook., *Blechnum orientale* Linn., *Asplenium unilaterale* Lam. var. *udum* Atk., *Phymatodes erythrocarpa* (Mett. ex Kze.) Ching, *Pyrrosia flocullosa* (Don) Ching, *Anogramma leptophylla* (L.) Link, *Selaginella subdiaphana* (Wall.) Spr. and *S. sanguinolenta* (L.) Spr. forma *aitchisonii* (Hieron.) Alston. Simla combines the flora of the the Eastern and North Western Himalayas and it may be treated as the western limit for *Blechnum orientale* Linn., *Sphenomeris chinensis* Maxon, *Dennstaedtia scabra* (Wall.) Moore, and *Asplenium unilaterale* Lam. Latest nomenclature has been used.

INTRODUCTION

There is no detailed account of the Pteridophytic Flora of Simla Hills. The only information available about the Ferns of Simla is from Blanford's two papers (1886, 1888) and Hope's (1921) list given in 'Flora Simlensis' by Collet (1921). No doubt, Hope's (1921) list of 'The Ferns of Simla' is very comprehensive, the author having enumerated a total of 124 species, but it completely lacks information concerning ecology, distribution, and altitudinal range of various species. Moreover, 'Fern-Allies' have not been included in that list.

The present observations on the Pteridophytic Flora were made in the summer of 1960 with a view to compile an upto-date list with latest nomenclature and to provide the distributional data.

GEOGRAPHICAL LIMITS

Simla, a popular health resort, is situated in the North Western Himalayas in about 31°6'N. latitude and 77°10'E. longitude with an average altitude of 2,170 m. It is very difficult to define the territorial limits of this work because the area surveyed falls within the present day political boundaries of the Punjab and Himachal Pradesh though according to an old concept of Collet (1921) the entire area was included in 'Simla District' of the then state of Punjab.

In addition to the survey of valleys around Simla (2,170 m.) and other nearby places of picnic interest such as Glen, Anandale, Chadwick Falls (1,500 m.), Tuti Kandi (1,500 m.), Tara Devi, Jutog, Summer Hill (2,100 m.), Boileauganj, Prospects Hill and Jakhu (2,415 m.), excursions were also taken to Charabara (2,430 m.), Kufri (2,550 m.), Mahasu (2,940 m.), Fagu (2,442 m.), Theog (2,460 m.), Matiana (2,280 m.), Narkanda (2,682 m.) and Kotgarh (2,400 m.) along Hindustan-Tibet road, Mashobra (2,400 m.), Thela (900 m), Gooma (750 m.) and Katnol (2,100 m.) enroute Shali, a limestone peak 32 Km. North-East of Simla.

The high altitude vegetation was sampled from Huttoo Peak (3,257 m.) near Narkanda and Shali Peak (3,150 m.). For study of lower altitude ferns vast areas around Kumarsen (900 m.) and Luri (600 m.) in Sutlej valley along Simla-Narkanda-Kulu road, were surveyed.

Thus the area explored is extensive and falls within an altitudinal range of 600-3,257 m. Shali and Hutto Peaks are the only elevations on which there is indication of sub-alpine vegetation.

CLIMATE

The climate of the area surveyed varies considerably from place to place depending upon altitude (there is difference of maximum of about 2,650 m. in the altitude of different places) and also on the factor of aspect whether Northern or Southern. Simla receives annually about 178 cm. of rain, principal amount (130 cm.) falls from June to September. As we proceed along Hindustan-Tibet road, the rainfall decreases, Kotgarh receives about half that of Simla. All the areas above 2,000 m. experience periodic snow fall between December to March. The snow continues to lie for several weeks. at certain places. The mean temperature at Simla during January (the coldest month) is about 4.44°C and during June (the hottest month) it is 19.44°C. The minimum temperature in January sometimes drops to -3.5°C. The temperature in the valleys below is always higher by about 6-11°C. The information about rainfall and mean temperature has kindly been provided by the Director, Regional Metereological Centre, New Delhi.

GENERAL ASPECT OF VEGETATION[1]

The general pattern of vegetation is almost the same as embodied in the 'Flora Simlensis' but considerable changes have taken place due to extensive cultivation and road building activity during the last forty years with the result that more and more areas are being denuded leading to soil erosion and disappearance of some uncommon and rare species. Here only a few general remarks will be made. The nature of vegetation varies a good deal with exposure, whether on Southern or Northern slopes and quality of soil. The woody elements largely predominate the vegetation around Simla. Therefore these remarks about the vegetation of Simla and adjacent hills mainly pertain to trees. The herbaceous element though far more numerous is not dominant. The herbs are often quite showy, particularly at higher altitudes.

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[1] For details the reader is referred to Collet (1921, pp. XLII-LII)

Pinus roxburghii Sargent (Chil) is usually common above 600 m. extending upto 1,800 m. There is very little undergrowth on the scorching arid Southern slopes. Higher up at 1,800-2,250 m. particularly around Simla it is replaced by conspicuously thick formations of *Cedrus deodara* Loud. The Blue Pine, *Pinus wallichiana* A. B. Jackson (=*P. excelsa* Wallich) has almost the same range as the deodar, growing slightly higher up also and being very common near Mashobra, Charabra and Kufri or even extending upto 2,700 m. Again *Picea smithiana* (Wallich) Boissier (=*P. Morinda* Link), the West Himalayan Spruce, forms a belt distinctly above *Cedrus deodara* Loud. between 2,250-2,700 m. especially around Hutto. *Abies spectabilis* (Don) Spach (=*A. webbiana* Lindl.), the Silver Fir and *Abies pindrow* Spach are common above 2,400 m. extending upto 3,600 m. These belts of conifers overlap each other in distribution. This zonation is clearly indicative of rough altitude. The Silver Fir is extremely common around Huttoo. The Yew (*Taxus baccata* Linn.) is very common near Lopho-ghati between Theog and Matiana at 2,400 m. in the Silver Fir Zone. *Cupressus torulosa* Don and *Ephedra girardiana* Wall. are localised to Shali area, at about 2,700 m. altitude, the former flourishing on the Northern slopes while the latter grows abundantly on the Southern side. This 3,150 m. high Shali Peak presents a conspicuously barren aspect on the Southern side with a temple adorning its top (Fig. 1).

Oaks also present a very characteristic zonation. *Quercus incana* Roxb. is usually associated with deodar and extends even upto 2,400 m., higher up it is being replaced by *Quercus dilatata* Lindl. (between 2,100-2,700 m.). *Abies pindrow* Spach forests are associated with *Quercus semicarpifolia* Sm. The red-flowered *Rhododendron arboreum* Sm. is quite common between 1,500-2,400 m. though often occurring at lower elevations on the Northern slopes. *Pieris ovalifolia* Don, *Cornus capitata* Wall., *Ilex dipyrena* Wall. and Maples are other common trees. *Betula alnoides* Ham. is common around Narkanda between 1,800-2,700 m. The undergrowth in case of Oak forest is very thick and mainly consists of herbs. In case of exclusively coniferous forests the vegetation on forest floor is usually meagre.

ECOLOGICAL AND DISTRIBUTIONAL NOTES

The forests around Simla are thick and support a variety of vegetation. Due to good amount of rainfall (177.8 cm.) epiphytic vegetation is quite common, good part of which consists of ferns. These ferns have seasonal growth, flourishing from June to September, the principal rainy months. These bring out new fronds in the rainy season, become fertile and then lie dormant throughout the winter season till the rains start next year. Usually when the rains stop in September, the fern fronds dry up and wither away. However, hardy ones or those growing in ravines are evergreen and go on putting up vegetative leaves throughout the year. One can find green fronds of *Polystichum squarrosum* Don., *P. aculeatum* Sw., *Lepisorus nudus* (Hook.) Ching, *L. excavatus* (Bory) Ching, *Adiantum venustum* Don, *Asplenium dalhousiae* Hook., *Onychium contiguum* Hope etc. even in the month of March after the snow melts.

The lower level ferns as *Ampelopteris prolifera* (Retz.) Copel, and *Pteris vittata* Linn. bring out new fronds throughout the year.

Simla is quite rich in Pteridophytic vegetation, in number of species as well as their abundance. The ferns constitute a very conspicuous element of the flora. As many as 121 species of ferns and fern-allies have been collected though the survey yet cannot be claimed as a final record.

Most of the ferns are either terrestrial or lithophytic but several of them grow as epiphytes. The conifers as a rule harbour very little epiphytic vegetation and much less of ferns. Only few times *Lepisorus nudus* (Hook.) Ching, *L. excavatus* (Bory) Ching, *Araiostegia pseudocystopteris* (Kze.) Copel., and *Polypodium microrhizoma* Clarke are seen to grow on *Cedrus deodara* or *Pinus wallichiana* or seldom on *Pinus roxburghii*. Mostly the ferns around Simla grow on *Rhododendron arboreum*, *Quercus* species and other trees. The commonest epiphytic ferns around Simla between 1,500-2,400 m. are: *Lepisorus nudus* (Hook.) Ching, *L. excavatus* (Bory) Ching (Fig. 2), *L. kashyapii* (Mehra) Mehra, *L. clathratus* (Clarke) Ching, *Polypodium microrhizoma* Clarke, *P. amoenum* Wall., *P. subamoenum* Clarke, *Araiostegia pseudo-cystopteris* (Kze.) Copel. (Fig. 3) and *A. pulchra* (Don) Copel. Towards Narkanda side near Theog *Drynaria mollis* Bedd. is common on *Quercus dilatata or sometimes* on *Cedrus deodara* while *Polypodium lachnopus* Wall., *Phymatodes oxyloba* (Wall.) Presl., *P. stewartii* (Bedd.) Ching (non *Polypodium stewartii* Clarke, (1880) and *P. malacodon* (Hook.) Ching are met with on *Abies pindrow*, and *A. spectabilis* near Huttoo or Shali Peak. *Asplenium planicaule* Wall., *A. ensiforme* Wall. (Fig. 4), *Loxogramme involuta* (Don) Presl, and *Leucostegia immersa* Wall. also grow as epiphytes though not common. *Microsorium membranaceum* (Don) Ching can be found at the base of the tree trunks at lower altitudes in ravines. At lower altitudes the epiphytic ferns are rare. Only once few individuals of *Pyrrosia flocullosa* (Don) Ching were seen growing on a mango tree near Gooma (750 m.) enroute Shali. Out of all the lower level (below 3,000 m.) conifers, *Cedrus deodara* is the best suited for epiphytic growth because of the somewhat vertical position of the needles (leaves) which often collect humus and thus provide very good substratum for the epiphytic ferns. These ferns because of their firm fixture on the humus collected on horizontal branches and amongst vertical needles of deodar undergo minimum amount of dislocation. On some deodar trees below Narkanda (2,100 m.) and near Lophoghati, a ridge between Theog and Matiana, several epiphytic ferns were found growing luxuriantly on huge mass of humus and mosses. One deodar tree supported as many as following seven epiphytic ferns: *Araiostegia pseudocystopteris* (Kze.) Copel., *Lepisorus nudus* (Hook.) Ching, *Lepisorus excavatus* (Bory) Ching, *Leucostegia immersa* Wall., *Loxogramme involuta* Presl, *Polypodium microrhizoma* Clarke and *Drynaria mollis* Bedd. (Fig. 5).

Gymnopteris vestita (Wall.) C. Chr. is very common all around Simla between ,500-2,700 m., altitude, mainly found on dry rocks. Another fern which establishes itself in the crevices of usually dry rocks by means of thick rhizomes covered with dark-brown scales, is *Hypodematium crenatum* (Forsk.) Kuhn., *Dryopteris chrysocoma* (Christ) C. Chr. also prefers exposed situations. *Selaginella adunca* A. Br. is exceedingly common on dry, exposed rocks near Thela (900 m.) on way to Shali Peak. Similarly *Adiantum incisum* Forsk. flourishes well all around in dry places at lower altitudes. Amongst the higher altitude ferns, *Woodsia elongata* Hook. thrives well in exposed rock crevices near Huttoo and Shali Peaks. *Cheilanthes chrysophylla* Hook., *Lepisorus nudus.* (Hook.) Ching, *Phymatodes malacodon* (Hook.) Ching, *P. oxyloba* (Wall.) Presl and *P. stewartii* (Bedd.) Ching also grow on exposed rocks in sub-alpine region.

Some of the ravine ferns, namely *Microsorium membranaceum* (Don) Ching, *Diplazium popypadioides* Bl., *D. spectabile* (Wall. ex Mett.) Bir *Woodwardia radicans* (L.) Sm., *Conio-gramme caudata* (Wall.) Ching, *Thelypteris subvillosa* (Moore) Ching, *T. erubescens* (Wall.) Ching, *T. brunea* (Wall.) Ching, *T. repens* (Hope) Ching, *Abacopteris multilineata* (Wall.) Ching and *Arthromeris wallichiana* (Spr.) Ching are very conspicuous and are common all around Simla between 900-1,800 m. Amongst the smaller ones that grow in ravines are *Adiantum capillus-veneris* L., *Dennstaedtia scabra* (Wall.) Moore, *Sphenomeris chinensis* Maxon and *Leptogramma totta* J. Smith. These grow alongside water channels at dark places. The last two mentioned species are rare and only collected from Tuti Kandi Khud and Chadwick Falls (1,500 m.). *Cyclosorus dentatus* (Forsk.) Ching and *C. papilio* (Hope) Ching grow in moist situations usually at lower levels.

Among the ferns which have got preference for shaded moist rocks may be mentioned *Oleandra wallichii* Presl, *Asplenium trichomanes* Linn. (Fig. 6), *A. exiguum* Bedd., *A. fontanum* Bernh., *A. sarelii* Hook., *A. unilatcrale* Lamk. var. *delicatulum* Par., and var. *udum* Atk., *Adiantum venustum* Don, *Polystichum stimulans* Presl, *P. thomsoni* (Hook. fil.) Bedd., *P. obliquum* Don, *P. acanthophyllum* (Franchet) Christ and *Didymoglossum insigne* v.d.B (= *Trichomanes bipunctatum* Poir. var. *insigne* v.d.B. Bedd. Handb. pp 41-42 1883). All of these except the last one, are common between 1,500-2,100 m. *Didymoglossum insigne* v.d.B. is localised to Chadwick Falls. *Anogramma leptophylla* (L.) Link, the smallest fern known, grows on moist rocks usually in protected places and often escapes notice because of the small size of the sporophyte which is hardly 4-5 cm. high and only 2-3 leaved.

Rest of the ferns mentioned are generally common on the forest floor though often they can be found on the sides of the roads or rarely on shaded rocks. The two areas that are particularly rich in the number of ferns are Glen (1,800 m.) and Chadwick Falls (1,500 m.). *Ophioglossum vulgatum* Linn. often grows mixed up with grass and can be overlooked.

The Pteridophytic vegetation of Simla Hills can be divided into the following altitudinal zones. There is no precise limit and the distribution of a particular species can overlap in two successive zones. Most of the ferns enumerated below are quite common in the localities mentioned in the beginning.

(1). *Upto 1,200 m. altitude:*

Pteris vittata Linn., *Ampelopteris prolifera* (Retz.) Copel., *Cyclosorus dentatus* (Forsk.) Ching and *Asplenium dalhousiae*, flourish very well at Luri (600 m.) in Sutlej valley near Narkanda. One individual of *Blechnum orientale* Linn. was found growing in rather exposed situation from this area. Few plants of *Equisetum debile* Roxb. were collected from this area though it is common in the plains. *Selaginella adunca* is common below Katnol near Thela (900 m.). Higher up, about 900 m., *Adiantum incisum* Forsk. is common everywhere. *Adiantum lunulatum* Burm. grows prolifically a little above Luri but preferring extremely moist conditions. Near Kumarsen (900 m.) *Hypolepis punctata* (Thbg.) Mett. grows in rather exposed but moist situation. At about 1,200 m., *Selaginella chrysocaulos* Spr. covers places along road sides in valleys below Simla. *Pteris quadriaurita* Retz., *Polypodium amoenum* Wall. and *P. sub-amoenum* Clarke are often seen everywhere. A few plants of *Equisetum ramosissimum* Desf. var. *altissimum* A. Br. were seen growing in ravine below Tuti Kandi on sandy soil. *Selaginella diaphana* (Wall.) Spr. grows in mats on

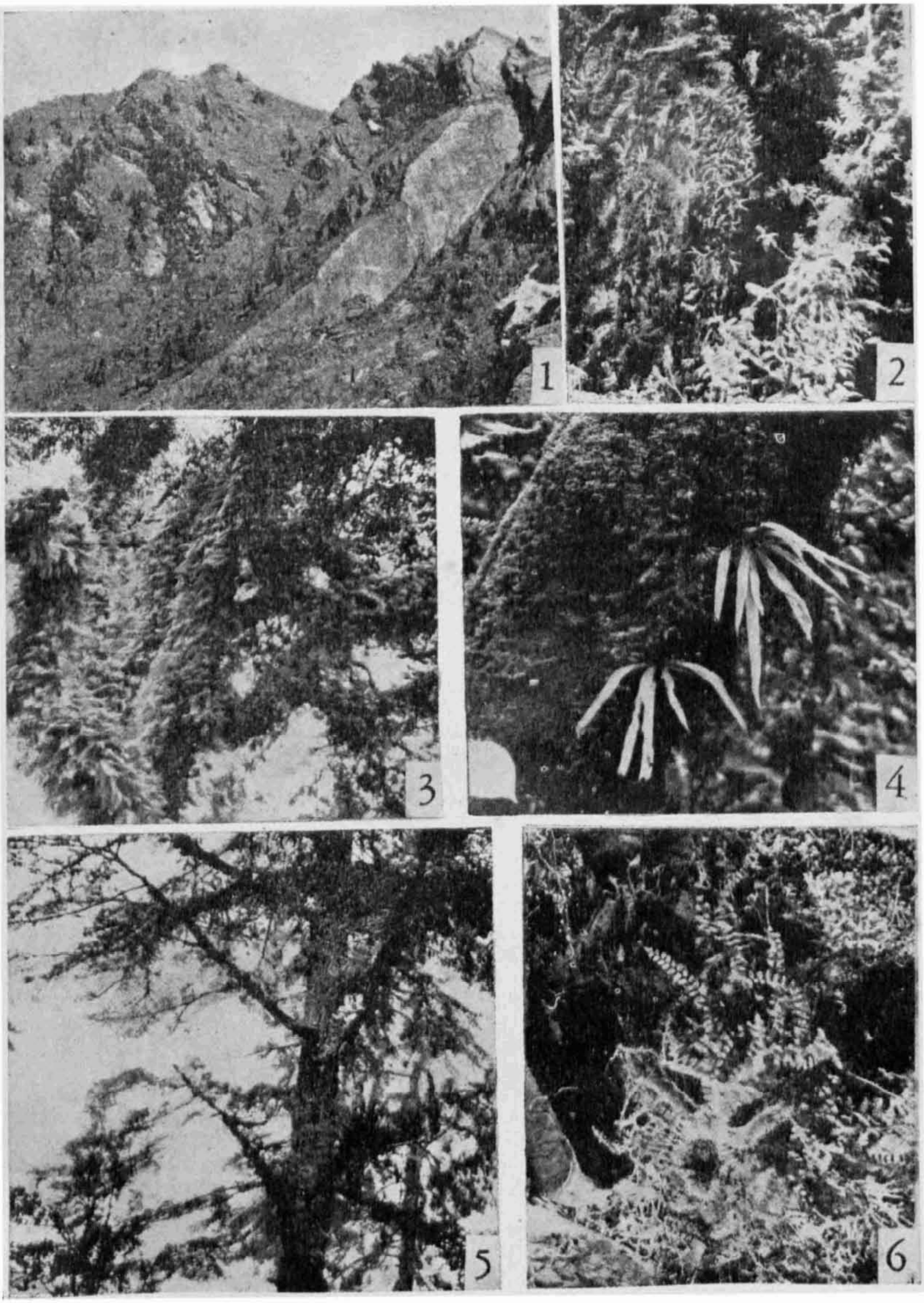

Fig. 1-6

1. Southern aspect of Shali Peak. It is conspicuously barren with isolated patches of *Abies spectabilis* usually in the pockets where moisture is available.
2. *Lepisorus excavatus* growing luxuriantly on the tree trunks in forests near Narkanda. Along with it can be seen *Phymatodes oxyloba* (right), *Lepisorus nudus* (hanging downwards), *Polypodium amoenum* and *P. microrhizoma.*
3. Epiphytic growth on *Quercus incana* tree growing near Kotgarh. The entire trunk and branches are covered with dense growth of *Araiostegia pseudocystopteris.*
4. **Individuals of *Asplenium ensiforme* hanging from moss laden tree trunk in the Glen, Simla.**
5. **Epiphytic growth on *Cedrus deodara* tree near Narkanda. The branches harbour a variety of ferns. *Drynaria mollis* and *Lepisorus excavatus* are very prominent.**
6. ***Asplenium trichomanes* growing in a crevice of dark, moist and shady rock.**

clay soil near Gooma (750 m.). One of the most rare ferns in this zone is *Dryopteris cochleata* (Don) C. Chr. This fern possesses dimorphic fronds. The fertile fronds are contracted at compared to the sterile ones. It was found growing near Luri (600 m.).

(2) *1,200-2,400 m. zone:*

The largest number of species occur in this zone. *Equisetum diffusum* Don grows commonly in khud near Tuti Kandi on sandy soil and cones frequently in September. *Botrychium lanuginosum* Wall. is rare and only few plants were collected around Summer Hill (1,800 m.). Similarly *Osmunda regalis* L. is localised to Chadwick Falls (1,500 m.) and is usually sterile. *Selaginella chrysorhizos* Spr. and *S. pallidissima* Spr. cover the rocks on roadsides all around, while *Selaginella sanguinolenta* (L.) Spr. forma *aitchisonii* (Hieron.) Alston with conspicuously red stem was collected only from near Katnol (2,400 m.) as growing on clay soil alongside road to Shali. Here *Selaginella sub-diaphana* (Wall.) Spr. also grows in abundance. *Leptogramma totta* J. Smith was collected only once growing on moist shaded rock in a ravine below Narkanda. A few plants of *Pteridium aquilinum* (L.) Kuhn were seen growing on forest floor near Mashobra (2,400 m.). *Anogramma leptophylla* (L.) Link was collected only from near Boileugunge (2,100 m.) growing on clay soil in somewhat obscure dark moist situation. The following ferns have been collected from this zone:

Osmunda regalis L., *Didymoglossum insigne* v.d. B., *Onychium contiguum* Hope, *Cheilanthes farinosa* (Forsk.) Klf., *Ch. dalhousiae* Hook., *Ch. albomarginata* Clarke, *Ch. grisea* Blanford, *Oleandra wallichii* (Wall.) Moore, *Gymnopteris vestita* (Wall.) C. Chr., *Dennstaedtia scabra* (Wall.) Moore, *Anogramma leptophylla* (L.) Link, *Sphenomeris chinensis* Maxon, *Pteris cretica* L., *P. quadriaurita* Retz., *Coniogramme caudata* (Wall.) Ching, *Co. fraxinea* (Don) Diels var. *denticulato-serrata* Hieron., *Adiantum venustum* Don, *Ad. edgeworthii* Hook., *Ad. capillus-veneris* L., *Araiostegia pulchra* (Don) Copel., *A. pseudocystopteris* (Kze.) Copel, *Leucostegia immersa* Wall.; *Hypodematium crenatum* (Forsk.) Kuhn, *Dryopteris odontoloma* (Moore) C. Chr., *D. chrysocoma* (Christ.) C .Chr., *D. marginata* (Wall.) C. Chr., *Cyclosorus papilio* (Hope) Ching, *Thelypteris brunea* (Wall.) Ching, *T. sub-villosa* (Moore) Ching, *T. erubescens* (Wall.) Ching, *T. repens* (Hope) Ching, *Abacopteris multilineata* (Wall.) Ching, *Diplazium polypodioides* Bl., *D. spectabile* (Wall. ex Mett.) Bir, *D. lobulosum* (Wall.) Presl, *Polystichum squarrosum* (Don) Fée, *P. thomsoni* (Hk. fil.) Bedd., *P. acanthophyllum* (Franch). Christ, *P. obliquum* (Don) Moore, *P. aculeatum* (L.) Schott., *P. stimulans* Presl, *Athyrium pectinatum* (Wall.) Presl, *A. clarkei* Bedd., *A. schimperi* Moug, *A. attenuatum* (Clarke) Tagawa, *A. anisopterum* Christ, *A. nigripes* (Bl.) Moore, *A. setiferum* C. Chr., *A. macrocarpum* (Bl.) Bedd., *A. thelypteroides* (Michx.) Desv., *A. fimbriatum* (Wall.) Moore, *A. rupicola* (Hope) C Chr., *A. japonicum* (Thbg.) Copel., *Asplenium dalhousiae*. Hook., *A. trichomanes* Linn., *A. ensiforme* Wall., *A. planicaule* Wall., *A. varians* Hook. et Grev., *A. unilaterale* Lamk. var. *delicatulum* Par., and var. *udum* Atk., *A. exiguum* Bedd., *A. sarelii* Hook., (only near Summer Hill, 2,100 m.), *A. fontanum* Bernh. (only near Shali, 2,400 m.), *Woodwardia radicans* (L.) Sm., *Loxogramme involuta* (Don) Presl, *Arthromeris wallichiana* (Spr.) Ching, *Microsorium membranaceum* (Don) Ching, *Lepisorus nudus* (Hook.) Ching, *L. excavatus* (Bory) Ching, *Polypodium microrhizoma* Clarke, *P. lachnopus* Wall., *Lepisorus kashyapii* (Mehra) Mehra. The fronds in case of the last fern turn brown on drying. Only once two individuals of *Athyrium boryanum* (Willd.) Tagawa were seen growing on forest floor below Kotgarh (2,100 m.). *Cyrtomium falcatum* Presl var. *caryotideum* (Wall.) Bedd. (=*C. caryotideum* Presl) is another fern which is rare in the area. Some individuals were collected from near Matiana growing near waterfall.

(3) *2,400-3,000 m. or above, including the sub-alpine region:*

Pteridium aquilinum (L.) Kuhn. is quite rare and few plants were seen near Mahasu (2,940 m.) and Huttoo Peak (3,150 m.) growing in grassy lands. *Dryopteris chrysocoma* (Christ) C. Chr. covers vast areas on the margins of forests around Charabra and Kufri, while *D. barbigera* (Moore.) O. Ktze. prefers exposed situations. Some specimens were collected growing under rocks on the Southern side of a Hill near Matiana. *Osmunda claytoniana* L. and *Athyrium dentigerum* (Clarke) Mehra et Bir grow in the forest just near Huttoo Peak. Similarly *Drynaria mollis* Bedd. grows epiphytically around Mattiana and Narkanda. *Coniogramme indica* Hieron. (= *C.* × *intermedia* Hieron.) and *C. fraxinea* (Don) Diels var. *denticulato-serrata* Hieron. grow luxuriantly in moist situations in the forest above Narkanda and Kotgarh. Two species of *Polystichum*, namely, *P. prescottianum* (Wall.) Moore and *P. acanthophyllum* (Franchet) Christ are seen generally growing under the rocks near Huttoo, Kotgarh and Hill near Matiana. *Araiostegia delavayi* (Bedd.) Copel. usually grows on *Quercus semicarpifolia* in a forest enroute Huttoo Peak 2,700 m. Other ferns which are common in this zone are:

Onychium contiguum Hope, *Adiantum venustum* Don, *Asplenium varians* Hook. et Grev., *Polystichum squarrosum* Don, *Athyrium schimperi* Moug., *A. attenuatum* (Clarke) Tagawa, *A. fimbriatum* (Wall.) Moore, *A. rupicola* (Hope) C. Chr., *Woodsia elongata* Hook., *Cheilanthes grisea* Blanford, *Asplenium dalhousiae* Hook. (rare), *Lepisorus nudus* (Hook.) Ching and *L. clathratus* (Clarke) Ching, *Polypodium amoenum* Wall. The last three ferns usually grow as epiphytes.

The most beautiful fern is *Adiantum pedatum* under *D. cochleata* (Don) C. Chr. as var. *schimperiana*. It may be pointed out that *Dryopteris cochleata* is far different from this fern, possesses dimorphic fronds with lower surface of the fertile fronds being completely hidden with sori and grows at lower altitudes, usually below 900 m. Recently, Stewart (1945) proposed a new name for this fern as *Dryopteris macrocarpa* without giving any reasons for the change. But in his subsequent paper Stewart (1957) abandoned the name *D. macrocarpa* and described this fern under *Dryopteris chrysocoma*, *D. schimperiana* (Hochst.) C. Chr. is endemic to Abyssinia (cf. Christensen, 1934) and according to Ching (1938) does not grow in the Himalayas. The Himalayan *D. chrysocoma* is very closely related to the Abyssinian species but differs in lamina being not deltoid in outline, the basal pinnae being not much the largest and basioscopically produced and the pinnules not so deeply lobato-incised (cf. Ching, 1938). The size of the frond in the present species can be anything from 15 cm. to 50 cm. It is very widely distributed throughout the Himalayas between 1,500-2,700 m. alt. It is extremely common in the Eastern Himalayas (Darjeeling & Sikkim State) but becoming relatively less frequent westward and extremely scarce in Kashmir.

(iv) **Asplenium dalhousiae** Hook. (=*A. alternans* Wall., Bedd. Handb. 142. 1883).

This fern has been referred to genus *Ceterach* by Christensen (1905) as *C. dalhousiae* (Hook.) C. Chr. and later on described as such by Mehra (1939) and Stewart (1942, 1945, 1957). Ching (1940) made it the type of his new genus *Ceterachopsis*. The taxonomic status of this group of ferns has already been discussed by the writer (cf. Bir, 1959, 1963). On the basis of morphological characters it was concluded that it really belongs to genus *Asplenium*.

The earlier name *Asplenium alternans* Wall. (List n. 221. 1828) is *nomen nudum* and hence illegitimate. Therefore, the name *Asplenium dalhousiae* Hook. (Ic. pl. t. 105.1837) is used here. It resembles very much *Ceterach officinarum* Lam. et DC. in outline of fronds which can be distinguished by anastomosing veinlets, presence of scales on the under surface of pinna lobes and absence of indusia.

A comparison of the names given by Mr. C. W. Hope in Collet's (1921) *'Flora Simlensis'* with those used in the present paper will indicate the nomenclatural changes that have taken place during the recent years. Following is the list of names of Simla ferns that have undergone a change. It is hoped it will help those who are conversant with the names used in the earlier works on Indian ferns.

Names according to Mr. C. W. Hope	Names used in the present paper
Trichomanes Filicula Bory	*Didymoglossum insigne* v.d.B. (*Trichomanes bipunctatum* var. *insigne* Bedd., Handb. 42. 1883).
Dicksonia scabra Wall.	*Dennstaedtia scabra* (Wall.) Moore
Davallia immersa Wall.	*Leucostegia immersa* Wall.
D. pseudocystopteris Kze.	*Araiostegia pseudocystopteris* (Kze.) Copel.
D. Beddomei Hope	*A. delavayi* (Bedd.) Copel.
D. tenuifolia Sw.	*Sphenomeris chinensis* Maxon.
Adiantum caudatum L.	*Adiantum incisum* Forsk. (pro parte)
Pteris aquilina L.	*Pteridium aquilinum* (L.) Kuhn.
Asplenium thelypteroides Michx.	*Athyrium thelypteroides* (Michx.) Desv.
A. macrocarpum Bl.	*A. macrocarpum* (Bl.) Bedd.
A. nigripes Mett.	*A. nigripes* (Bl.) Moore
A. tenellum Hope	*A. setiferum* C. Chr.
A. tenuifrons Wall.	*A. clarkei* Bedd.
A. Filix-foemina Bernh. var. *dentigera* Clarke	*A. dentigerum* (Clarke) Mehra et Bir
A. rupicola Hope	*A. rupicola* (Hope) C. Chr.
A. pectinatum Wall.	*A. pectinatum* (Wall.) Presl
A. schimperi A. Br.	*A. schimperi* Moug.
A. fimbriatum Hook.	*A. fimbriatum* (Wall.) Moore
A. foliolosum Wall.	*A. foliolosum* (Wall. ex Clarke) Bedd.
A. longifolium Don	*Diplazium lobulosum* (Wall.) Presl
A. japonicum Thbg.	*Athyrium japonicum* (Thbg.) Copel.
A. polypodioides Don	*Diplazium polypodioides* Bl.
A. multicaudatum Wall.	*D. spectabile* (Wall. ex Mett.) Bir
Aspidium obliquum Don	*Polystichum obliquum* (Don) Moore
A. illicifolium Don	*P. stimulans* Presl

Names according to Mr. C. W. Hope	Names used in the present paper
A. acanthophyllum Franchet	*P. acanthophyllum* (Franch.) Christ
A. Thomsoni Hook.	*P. thomsoni* (Hook. fil.) Bedd.
A. angulare Willd.	*P. aculeatum* (L.) Schott.
A. squarrosum Don	*P. squarrosum* (Don) Fee
A. prescottianum Hook.	*P. prescottianum* (Wall.) Moore
A. falcatum Sw.	*Cyrtomium falcatum* Presl
Nephrodium repens Hope	*Thelypteris repens* (Hope) Ching
N. barbigerum Hook.	*Dryopteris barbigera* (Moore) O. Ktz.
N. schimperianum Hope	*D. chrysocoma* (Christ) C. Chr.
N. cochleatum Don	*D. cochleata* (Don) C. Chr.
N. Blanfordii Hope	*D. blanfordii* (Hope) C. Chr.
N. ramosum Hope	*D. ramosa* (Hope) C. Chr.
N. odontoloma Moore	*D. odontoloma* (Moore) C. Chr.
N. marginatum Wall.	*D. marginata* (Wall.) C. Chr.
N. crenatum Baker	*Hypodematium crenatum* (Forsk.) Kuhn
N. Boryanum Bak.	*Athyrium boryanum* (Willd.) Tagawa
N. molle Desv.	*Cyclosorus dentatus* (Forsk.) Ching
N. papilio Hope	*C. papilio* (Hope) Ching
Polypodium erubescens Wall.	*Thelypteris erubescens* (Wall.) Ching
P. distans Don	*T. brunea* (Wall.) Ching
P. punctatum Thbg.	*Hypolepis punctata* (Thbg.) Mett.
P. multilineatum Wall.	*Abacopteris multilineata* (Wall.) Ching
P. rivale Mett.	*Drynaria mollis* Bedd.
P. lineare Thbg.	*Lepisorus nudus* (Hook.) Ching
P. membranaceum Don	*Microsorium membranaceum* (Don) Ching
P. oxylobum Wall.	*Phymatodes oxyloba* (Wall.) Ching
P. malacodon Hook.	*P. malacodon* (Hook.) Ching
P. Stewartii Clarke	*P. stracheyi* Ching
P. ebenipes Hook.	*P. ebenipes* (Hook.) Ching
P. juglandifolium Don	*Arthromeris wallichiana* (Spr.) Ching
P. clathratum Clarke	*Lepisorus clathratus* (Clarke) Ching
P. late-repens Hope	*Thelypteris brunea* (Wall.) Ching
Gymnogramme totta Schlecht	*Leptogramma totta* J. Smith
G. vestita Hook.	*Gymnopteris vestita* (Wall.) C. Chr.
G. levingei Bak.	*Thelypteris levengei* (Clarke) Ching
G. javanica Bl.	*Coniogramme fraxinea* (Don) Diels
G. involuta Hook.	*Loxogramme involuta* Presl

COMMENTS

From Simla area 121 species have been collected by the writer though the record cannot be claimed as final. Areas above 3,300 m. alt. were not surveyed especially the Chor Peak which is to the south-east of Simla and 3,600 m. high. Consequently many high altitude ferns as *Cystopteris fragilis* Bernh., *Notholaena marantae* R. Br., *Asplenium septentrionale* Hoffm. (usually growing near the snow line), *Pteris excelsa* Gaud., *Cryptogramma crispa* (L.) R. Br. and *Asplenium adiantum-nigrum* L. could not be collected. There are also some other ferns met with at lower altitudes as *Ceratopteris thalictroides* Bougn. (growing in ponds etc.), *Cheilanthes subvillosa* Hook., *Pellaea nitidula* Bak., *P. calomelanos* Link, *Onychium auratum* Kaulf., *O. japonicum* Kze., *Asplenium mackinnoi* Hope [=*Athyrium mackinnoi* (Hope) C. Chr.] *Botrychium lunaria* Sw., *B. ternatum* Sw. etc. that are not reported here. These are presumably rare because the writer did not come across these during his extensive tour of the area. All of the above named 15 ferns have earlier been listed from Simla by Hope (1921). It is not certain whether the area explored during the present observation and that covered by Hope (1921) while compiling the list of 'Ferns of Simla' is exactly the same or not. Therefore, many ferns reported earlier were not found by the writer. A list of such sixteen species, in addition to 15 mentioned above, is given below. Wherever there are nomenclatural changes, the latest names are given within brackets.

Davallia clarkei Baker [=*Araiostegia clarkei* (Bak.) Copel.], *Cheilanthes anceps* Blanford, *Pteris digitata* Wall. (=*P. stenophylla* Wall.), *Aspidium marginatum* Wall. [=*Polystichum nepalense* (Spr.) C. Chr.], *A. lobatum* Sw. [=*Polystichum lobatum* (Huds.) Presl], *A. bakerianum atkinson* [=*Polystichum Bakerianum* (Atk.) Diels] *Nephrodium* *gamblei* Hope[2] [=*Dryopteris serrato-dentata* (Bedd). Hayata?], *N. thelypteris*[2], *N. filix mas* Rich. [= *Dryopteris filix mas* (L.) Schott], *N. parallelogrammum* Kze. (=*Dryopteris filix mas* var.), *N. kingu* Hope (=*Dryopteris filix mas* var.), *N. cicutarium* Baker [=*Tectaria macrodonta* (Fée) C. Chr.], *Polypodium dryopteris* L. (=*Dryopteris linnaeana* C. Chr.), *P. lineatum* Colebr[2], *P. fissum* Baker [= *Pyrrosia porosus* (Wall.) Ching], and *Polypodium stewartii* Clarke=(*Phymatodes stracheyi* Ching).

It is just possible that some of the rare species may have disappeared from the area due to change in topography caused by frequent landslips, increased road building activity and intensive cultivation.

Out of 121 species recorded in this paper, 9 belong to Fern-Allies and 112 to ferns. So with the inclusion of above named 31 fern species recorded by Hope (1921) but not collected by the writer, the number of ferns alone so far reported from Simla comes to 143 and such a high number is a testimony to the richness of Simla in the Pteridophytic flora.

Simla may be treated as the Western limit of predominantly East Himalayan elements as *Blechnum orientale* Linn., *Sphenomeris chinensis* Maxon, *Dennstaedtia scabra* (Wall.) Moore, *Asplenium unilaterale* Lamk. etc. Similarly members of genus *Pyrrosia* are rare in Simla area while these are very common around Mussoorie where the genus is represented by four species. Several Mussoorie ferns such as *Microlepia platyphylla* J. Smith, *Diplazium esculentum* (Retz.) Sw., *Lygodium salicifolium* Presl and *L. japonicum* (Thunb.) Bedd. are not met with in Simla. The last one is again common in Kashmir and West Pakistan (cf. Stewart, 1957).

Further it may be pointed out that some ferns as *Asplenium sarelii* Hook., *Dryopteris blanfordii* (Hope) C. Chr. and *D. ramosa* (Hope) C. Chr. are those elements in the flora of Simla which are not reported so far east of Simla and are abundant westward particularly in Kashmir.

Though the number of epiphytic species around Simla may be the same as at Mussoorie but there is definite decrease in their abundance as compared to Mussoorie. This is due to the fact that Mussoorie receives more rain than Simla. Here it will be of interest to mention that in the Himalayas the fern epiphytic flora goes on decreasing as one proceeds westwards from Darjeeling. This is obviously correlated with corresponding decrease in rainfall from Eastern to Western Himalayas.

NEW RECORDS

Following is the list of 21 members of Pteridophytes that are reported for the first time by the writer from Simla Hills. The specimens are preserved in the Herbarium of the Botany Department, Panjab University, Chandigarh-3, India.

1. *Araiostegia pulchra* (Don) Copel.
2. *Cheilanthes chrysophylla* Hook.
3. *Blechnum orientale* Linn.
4. *Asplenium unilaterale* Lamk. var. *udum* Atk.
5. *Athyrium anisopterum* Christ
6. *A. attenuatum* (Clarke) Tagawa
7. *Ampelopteris prolifera* (Retz.) Copel.
8. *Dryopteris fibrillosa* (Clarke) Hand.-Mazz.
9. *D. paleacea* (Don) Hand-Mazz. [=*Dryopteris wallichiana* (Spreng.) Alston et Bonner]
10. *Phymatodes erythrocarpa* (Mett ex Kunze) Ching
11. *P. sub-amoenum* Clarke
12. *Lepisorus kashyapii* (Mehra) Mehra
13. *Pyrrosia flocullosa* (Don) Ching
14. *Coniogramme indica* Hieron.
15. *C. caudata* (Wall.) Ching
16. *Annogramma leptophylla* (L.) Link
17. *Thelypteris sub-villosa* (Moore) Ching
18. *Asplenium dalhousiae* Hook.
19. *A. sarelii* Hook.
20. *Phymatodes stewartii* (Bedd.) Ching
21. *Selaginella sub-diaphana* (Wall.) Spr.
22. *S. sanguinolenta* (L.) Spr. forma *aitchisonii* (Hieron.) Alston

SUMMARY

The paper deals with the ecological and distributional data about the Pteridophytic Flora of Simla Hills (North Western Himalayas). One hundred and twenty-one members have been collected from the area out of which 22 species are new records.

Taxonomic status of *Didymoglossum insigne* v.d.B., *Dryopteris chrysocoma* (Christ) C. Chr. and *Asplenium dalhousiae* Hook. has been discussed.

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LITERATURE CITED

BEDDOME, R. H. '*The Ferns of Southern India*'. Gantz Brothers. Madras. 1863.

——'*A Handbook to the Ferns of British India, Ceylon and Malay Peninsula*, Thacker, Spink & Co., Calcutta. 1883.

——'*A Handbook to the Ferns of British India, Ceylon and Malay Peninsula*'. With Supplement. Thacker, Spink & Co., Calcutta. 1892.

BIR, S. S. 'Cytotaxonomic Notes on Some Aspleniaceae from Kulu Valley'. *Journ. Indian Bot. Soc.* 38 : 528-539, 1959.

——'Evolution in the Indian Members of Genus *Asplenium* Linn'. *Memoirs Ind. Bot. Soc.* No. 4. 41-50, 1963.

—— AND S. C. VERMA. 'Ferns of Mount Abu'. Res. *Bull.* (N. S.) *Panjab Univ.* 14 : 179-194, 1963.

BLANFORD, H. F. 'The Silver Ferns of Simla and their Allies'. *Jour. Simla Naturalists Soc.* 2 : 13-22, 1886.

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[2] Valid name not clear.

—— 'A list of the Ferns of Simla in the N. W. Himalayas, between levels of 4,500 and 10,500 ft.' *Jour. Asiatic Soc. Bengal* 57 : 294-315, 1888.

CHING, R. C. 'A Revision of the Chinese and Sikkim Himalayan *Dryopteris*'. *Bull. Fan. Mem. Inst. Biol.* 8 : 275-334, 365-507, 1938.

—— *Bull. Fan. Mem. Inst. Biol. Bot. Soc.* 10 : 9, 1940.

CHRISTENSEN, C. $\frac{\text{'Index Filicum'}}{\text{1905—1906}}$. Hagerup (Hafiniae).

—— *'Index Filicum'*. Supplementum Tertium. Pro Annis 1917-1933. apud H. Hagerup. Hafiniae. 1934.

CLARKE, C. B. 'A Review of Ferns of Northern India.' *Trans. Linn. Soc.* London. II, Bot. 1 : 425-611, 1880.

COLLET, H. *'Flora Simlensis'*. 2nd Impression. Thacker, Spink & Co., Calcutta. 1921.

COPELAND, E. B. 'Genera Hymenophyllacearum'. *Philip. Jour. Sci.* 67 : 1-110, 1938.

—— *'Genera Filicum'* Chronica Botanica Co. Waltham Mass., U. S. A. 1947.

HOPE, C. W. 'The Ferns of North Western India'. *Journ. Bombay. nat. Hist. Soc.* 14 : 720-749, 1903.

—— 'Ferns of Simla' in H. Collet's *'Flora Simlensis'*. 1921.

MEHRA, P. N. 'Ferns of Mussoorie', *Panjab Univ. Publ.* Lahore. 1939.

—— AND G. SINGH. Cytology of Hymenophyllaceae'. *Journ. Genetics.* 55 : 379-393, 1957.

STEWART, R. R. 'The Ferns of Mussoorie and Dehra Dun'. *150th Anniversary Vol. Roy. Bot. Gard.* Calcutta. Part II, 159-172, 1942.

—— 'Ferns of Kashmir'. *Bull. Torrey. Bot. Cl.* 72 : 399-426, 1945.

—— 'The Ferns and Fern-Allies of West Pakistan and Kashmir.' Biologia 3 : 133-164, 1957.